University of Michigan Health System

Mott Operating Room

Analysis of Current Mott Operating Room Instrument Processing

Final Report

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Date: December 8, 2008
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Executive Summary

The replacement C.S. Mott Children’s and Women’s hospital, currently under construction, will need an operational plan for its instrument processing facilities. The instrument processing process includes the transfer, decontamination, sterilization, assembly, and storage of surgical instrument sets used in the Mott operating rooms. The staff would like the specifics of the current process documented to lay a foundation of the process plan for the replacement hospital. The goals of this project were to analyze the current instrument process at the existing C.S. Mott Children’s and Women’s hospital to lay the foundation for the replacement hospital’s Central Sterile Reprocessing (CSS) area operational plan, determine the amount of sterile shelving necessary at current inventory levels, perform a 5S analysis to standardize the instrument room workstations. While the process is effective in its current state, the Nurse Manager of the Mott operating rooms asked the team to find areas for improvement.

Background

The Mott hospital’s instrument sterilization area is currently processing instruments from its nine full service pediatric operating rooms and two minor-treatment rooms, which perform procedures on an average of 40.6 patients each day. The replacement hospital’s CSS area, scheduled to open in 2012, will service the entire hospital and, therefore, will increase in size according to the recommended area. Staff will increase from 12 to 30 instrument processors who will be trained in the current hospital. The current instrument processing area is much smaller than HKS Incorporated recommendations based on annual volume, and multiple issues compromise the efficiency of the instrument processing area and operating rooms. After examining the current situation, the team has developed recommendations to increase the efficiency of the CSS area.

Methodology

The team has compiled data through six methods: literature search, time studies, interviews, observations, measurements, and existing data.

- **Performed literature and internet searches for a better understanding of the instrument processing process.** These searches also included collecting information on the details of a 5S analysis.
- **Conducted time studies to quantify the current instrument process.** Time was recorded to:
  - Deliver a dirty instrument set to the decontamination room.
  - Sort, count, hand wash, and load instruments into the washing machines.
  - Run one cycle on the spray, sonic, and high-temperature washing machines.
  - Assemble instruments sets. For two weeks, instrument processors recorded this data.
  - Cool instruments sets after sterilization. For one week, instrument processors recorded this data.
- **Interviewed the Instrument Room Supervisor and each of the instrument processors.** Through an interview with the Instrument Room Supervisor, the team recognized an opportunity for increased efficiency of instrument set assembly through the plan and implementation of a 5S analysis on the area’s 5 workstations. The interviews also were used to collect information on:
• Workstation standardization
• Instrument process mapping
• Waste identification

• **Observed the decontamination room and inventory assembly and sterilization room.** The team observed these rooms for a total of 150 hours to gain insight for the 5S analysis and implementation and to map the instrument process.

• **Measured linear footage.** The team measured the current amount of shelving in the sterile storage area and combined this information with an existing instrument set inventory list to estimate the amount of sterile shelving necessary at the current level of instrument inventory. A project by Program and Operations Analysis will use this estimation to extrapolate the required amount of shelving in the replacement hospital.

• **Analyzed existing data.** The Nurse Manager provided two weeks of autoclave usage logs, which was used to quantify the usage of the autoclave. She also provided instrument processor productivity sheets from April 2008 and July 2008, which was used to define the system state. The Instrument Room Supervisor supplied a complete listing of instrument sets, categorized by set size.

### Results

Based on observations and time studies, the team developed a high level value stream map. This map of the current state shows the process of each instrument set travelling from the operating room through the decontamination room, instrument assembly room, sterilization area, sterile storage area and back to the operating room. The current process produces 62-181 sets each day. The production lead time for the entire process is 10.6 hours and the processing time is 4.1 hours. Table 1 shows a breakdown of individual task times.

<table>
<thead>
<tr>
<th>Task</th>
<th>Number of Operators</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inventory between Operating Rooms and Decontamination</td>
<td>N/A</td>
<td>&lt; 1 hour</td>
</tr>
<tr>
<td>Decontamination</td>
<td>1-2</td>
<td>63.8 minutes</td>
</tr>
<tr>
<td>Inventory between Decontamination and Instrument Assembly</td>
<td>N/A</td>
<td>&lt; 3 hour</td>
</tr>
<tr>
<td>Instrument Assembly</td>
<td>4-5</td>
<td>15.3 minutes</td>
</tr>
<tr>
<td>Inventory between Instrument Assembly and Sterilization</td>
<td>N/A</td>
<td>&lt; 2.5 hours</td>
</tr>
<tr>
<td>Sterilization</td>
<td>1</td>
<td>163.2 minutes</td>
</tr>
</tbody>
</table>

Existing autoclave records were also used to determine the average number of main autoclave cycles by day of the week. During the work week, Monday has the lowest average with 6.33 cycles and Tuesday has the highest average with 8.25 cycles. During the weekend, Saturday has an average of 1.67 cycles and Sunday has an average of 2 cycles.

The information obtained from the instrument processor productivity sheets shows that daily productivity rate in July is higher than April. July was chosen to represent a month in which a high
number of surgeries are scheduled because children are not in school. April was chosen to represent the lower number of surgeries that occur during the school year.

The team used the instrument set inventory list, alongside measurements of the six instrument set sizes to derive that 1,031 square feet of sterile shelving is necessary at the current inventory levels.

The team performed a 5S analysis on the instrument assembly room workstations. The results from this analysis can be seen in Figure 1.

Figure 1: 5S Analysis Results

As shown above, the 5S analysis and implementation eliminated excess inventory clutter and increased organization to optimize work efficiency.

**Recommendations**

The following recommendations will increase the efficiency of the current instrument process and help lay the foundation of the replacement hospital's CSS area operational plan:

Primary recommendations include:
- Performing biweekly 5S maintenance on the workstations in the instrument assembly room.
- Preplanning a 5S implementation program for the replacement hospital CSS area.

Based on observations and interviews, the team makes the following recommendations:
- Increase the number of supply deliveries to the instrument assembly room from once to twice daily to resolve clutter and overstocking and increase the amount of space.
- Use a first in, first out (FIFO) method in decontamination except for urgent sets.
- Redesign the battery inventory storage to FIFO dispensing system to eliminate dead batteries.
- Move the Bowie Dick and biological indicator tests from the shelf above the workstation to a shelf by the autoclave to create space and eliminate walking time.
- Devise a checkout system for individual instruments to reduce instrument misplacement issues.
- Transition hand wrapped sets to Genesis cases, if possible, as a form of standardization and protection.
Introduction

The replacement C.S. Mott Children’s and Women's hospital, currently under construction, will need an operational plan for its instrument processing facilities. The instrument processing process includes the transfer, decontamination, sterilization, assembly, and storage of surgical instrument sets used in the Mott operating rooms. The staff would like the specifics of the current process documented to lay a foundation of the process plan for the replacement hospital. The current instrument processing area is much smaller than recommendations based on the annual volume, and multiple issues compromise the efficiency of the instrument processing area and operating rooms. To quantify this process, the Nurse Manager of the Mott operating rooms would like to map the process in its current state.

The replacement hospital’s Central Sterile Reprocessing (CSS) area will gain additional responsibilities and services. The goal of this project was to quantify the current instrument processing process to lay the foundation of the operational plan for the replacement hospital CSS area. The team also was to recommend improvements to the current system, perform a 5S analysis, and standardize the instrument room workstations. To make these recommendations, the team observed the current process and conducted time studies on the tasks of the instrument process. Additionally, the team mapped processes on both a high-level and high-detail scale, calculated the amount of sterile shelving necessary at current inventory levels, and identified wasted work and resources. The purpose of this document is to report on the findings of the project, along with the methods used to reach these findings.

Background

C.S. Mott Children’s and Women’s Hospital currently has nine full service pediatric operating rooms and two minor-treatment rooms. On average, these operating rooms perform procedures on 40.6 patients each day, as calculated from hospital records. The instruments from these procedures are currently processed in rooms much smaller than HKS Incorporated recommendations, as seen below in Table 2.

<table>
<thead>
<tr>
<th>Room</th>
<th>Current Mott Hospital (Sq. Ft.)</th>
<th>New Mott Hospital (Sq. Ft.)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Actual Area</td>
<td>HKS Inc. recommendation</td>
</tr>
<tr>
<td>Decontamination</td>
<td>277</td>
<td>800</td>
</tr>
<tr>
<td>Instrument Assembly &amp;</td>
<td>450</td>
<td>1000</td>
</tr>
<tr>
<td>Sterilization</td>
<td>846</td>
<td>955</td>
</tr>
<tr>
<td>Sterile Storage Area</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Currently, the instrument room is servicing only the C.S. Mott Children’s and Women’s Hospital operating rooms. The replacement hospital is scheduled to open in 2012 with a new CSS area. The new CSS area will increase in size to handle new responsibilities that will include providing sterilization services to the entire replacement hospital. As seen in Table 1, the planned size of the replacement hospital CSS area meets the higher recommended square footage to adapt for these added
responsibilities. To accommodate for this increase, the new CSS area will increase from one to two large capacity autoclaves, with space for a third unit to be installed when needed. The increase in the number of instrument sets has created a need to determine the amount of shelving required for the instrument sets in the new CSS area. Staffing will increase from 12 to 30 instrument processors. Training for the replacement hospital’s staff will take place in the current instrument assembly room, which demonstrates the need for standardized workstations so that employees can move from station to station without confusion due to the misplacement of supplies. Another area of the current process also involves transport of contaminated instruments to the decontamination room. The new process will include an enclosed case cart system to fully contain the contaminated instruments during transportation.

The steps involved with this process are listed below:

1. After the final instrument count and upon completion of the surgical case, the patient and staff exit the operating room.
2. The surgical technologist collects all instruments used during the surgical case, and prepares them for transport to the decontamination room by placing them on a bipod and covering them.
3. In the decontamination room, each instrument set is counted again. If instruments are missing, the following actions take place:
   - A surgical technologist is notified so that he or she can check the corresponding operating room
   - Trash from the operating room is searched
   - Instrument processors are notified to be on the lookout for extra instruments
4. Instruments then go through a thorough cleaning according to the type and cleanliness, including a combination of:
   - Hand washing
   - Sonic washing
   - High-temperature washing
   - Soaking
5. The instruments enter the instrument assembly and sterilization room through either the high-temperature washing machine or a service window.
6. An instrument processor assembles instruments into sets and prepares them for sterilization.
7. These sets are placed onto a large cart that is rolled into the autoclave.
8. The sterilization machine cycles, and the cart is removed from the autoclave.
9. The instruments cool for approximately one hour, or until cool to the touch.
10. The sets are stored in the sterile storage area or placed directly onto bipods for another case.
11. The inventory coordinator assembles the bipods using physician preference cards: lists generated daily detailing all instruments required for the surgical procedure.
12. A perioperative technician transports the bipods to an operating room and the process repeats after the completion of the next case.
Each of these steps has been quantified and detailed in the team’s current state value stream map.

**Key Issues**

The following key issues led to the need for this project:

- Need for an operational plan for the CSS area for the replacement hospital
- Non-standardized workstations
- System of instrument transportation that allows for lack of containment
- Miscounting and misplacement of instruments

**Goals and Objectives**

The primary goal of the project was to document the current state of instrument processing and to quantify the steps in the instrument processing process. The team has developed recommendations to:

- Develop and maintain standardized workstations
- Provide a clear picture of the path each individual type of instrument set takes
- Determine the amount of shelving required at the current level of instrument inventory

**Project Scope**

This project included the examination of the current process in the Mott instrument rooms. The team’s findings will be used in future analyses to recommend changes in the current system and the system at the replacement hospital.

Any tasks not associated with the instrument flow process in the Mott Operating Room were not incorporated into the project. The inventory process, including ordering, reordering and changes in usage, was not to be addressed.

**Data Collection Methods**

The team has compiled data through six methods: literature search, time studies, interviews, observations, measurements, and existing data.

**Literature Search**

For a better understanding of the background of the instrument processing process, the team researched the instrument sterilization process at other hospitals. Due to the lack of space in the Mott hospital, the standard size of processing rooms was of particular interest, as well as the decontamination procedures. Additionally, the team researched the details of a 5S analysis. 5S is a method of standardization, originating from lean manufacturing. There are 5 parts:

1. Sort: Distinguish between what is needed and not needed. This step rids a workstation of unnecessary items.

2. Sweep: Clean and look for ways to keep the workstation clean and organized. A clean workstation helps workers work more efficiently, and maintain workstation standards.
3. Set in Order: Find a place for everything and put everything in its place. If all necessary items for a process are kept in a specific space, a worker will not spend time searching for commonly used materials.

4. Standardize: Maintain and monitor the first three categories. Maintaining visual controls of the standards will help to identify problems with the work done in the previous three steps.

5. Sustain: Stick to the rules. Training workers on 5S, and performing daily 5S upkeep and inspections will help to maintain workspace standardization.

Materials on 5S were obtained through course notes from Industrial and Operations Engineering 425: Manufacturing Strategies.

**Time Studies**
The team has conducted time studies to quantify the instrument process. The team recorded the time taken to:

- Deliver a dirty set of instruments to the decontamination room after a patient leaves the operating room.
- Sort, count, hand wash, and load instruments into the washing machine in the decontamination room.
- Run one cycle on the spray, sonic, and high-temperature washing machines in the decontamination room.
- Assemble instrument sets. This data was recorded by the 12 instrument processors over a period of two weeks.
- Cool instrument sets after sterilization. This data was recorded by the instrument processors for approximately one week.

**Interviews**
The team interviewed the Instrument Room Supervisor and each of the instrument processors to collect information needed to:

- Standardize workstations
- Map the instrument assembly process
- Locate waste throughout the process

**Observations**
The team observed the decontamination room and the instrument assembly and sterilization room to gather details in mapping the current state of the instrument process. Throughout these observation periods, the team gathered insight for the 5S analysis and implementation and developed recommendations to eliminate waste.
**Measurements**

The team measured the linear footage of instrument trays and the current amount of shelving in the sterile storage area. The instrument tray data, when combined with an existing instrument set inventory list, was used to estimate the amount of sterile shelving necessary at the current inventory levels.

**Existing Data**

The Instrument Room Supervisor provided existing data related to autoclave usage and instrument processor productivity. The Instrument Room Supervisor also provided an instrument set inventory list broken down into categories based on size.

**Autoclave Usage**

The team examined the usage logs from the autoclave for two weeks. The team has compiled these logs into an electronic spreadsheet to quantify the usage of the autoclave.

**Instrument Processor Productivity**

The team has analyzed the productivity worksheets from April 2008 and July 2008 and compiled them into an electronic spreadsheet to define the system state. The productivity worksheets have a detailed perspective on the tasks the instrument processors perform throughout a shift:

- **Decontamination Room:**
  - Number of bipods washed
  - Number of outside trays washed
  - Number of instrument sets hand-washed
  - Number of individual items cleaned
  - Number of scopes processed
  - Total number of instrument sets washed

- **Instrument Assembly and Sterilization Room:**
  - Number of times the washer was unloaded
  - Number of instrument sets assembled
  - Number of individual instruments assembled
  - Number of sterile loads put away
  - Type of instrument sets assembled
  - Deliveries to the birth center, University Hospital, and University Hospital CSS area

- **Autoclaves**
  - Number of loads processed through the autoclave
  - Number of loads removed from the autoclave
  - Number of hallway autoclave cycles

**Instrument Set Inventory List**

The team used the instrument set inventory list alongside measurements of six different instrument set sizes to derive an estimate of the amount of sterile shelving necessary at the current inventory levels. The six instrument sizes are defined in Table 3.
Table 3. Instrument Set Sizes

<table>
<thead>
<tr>
<th>Set Type</th>
<th>Measurement (Length x Width)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Genesis Container (Container Size)</td>
<td></td>
</tr>
<tr>
<td>Half Length</td>
<td>11” x 12”</td>
</tr>
<tr>
<td>Mid Length</td>
<td>19” x 12”</td>
</tr>
<tr>
<td>Full Length</td>
<td>23” x 12”</td>
</tr>
<tr>
<td>Wrapped Sets (Wrap Size)</td>
<td></td>
</tr>
<tr>
<td>54” x 54”</td>
<td>24” x 13”</td>
</tr>
<tr>
<td>36” x 36”</td>
<td>20” x 11”</td>
</tr>
<tr>
<td>24” x 24”</td>
<td>14” x 10.5”</td>
</tr>
</tbody>
</table>

Analysis Methods and Tools

The team used Microsoft Office Excel to compile and organize data collected throughout the project. Charts and graphs developed for the presentation were also created in Microsoft Office Excel. Value steam maps and swim lane diagrams were created in Microsoft Office Visio. The team met with a 5S expert to develop an implementation strategy for the 5S analysis.

Results

The project consisted of three parts: quantification of the current state of the instrument process, measurement of instrument trays and shelving, and 5S analysis and implementation.

Quantification of the Current State of the Instrument Process

The team spent approximately 150 hours observing the instrument process throughout decontamination, instrument assembly, and sterilization. Instrument processors and the Instrument Room Supervisor added valuable insight into the process throughout these observations. Based on these observations, the team has created a high-level flowchart of the instrument process, seen in Appendix A. This flow chart and the time studies helped to develop a high level value stream map as seen in Figure 2. The process produces 62-181 sets each day. The production lead time for the process is 10.6 hours and the processing time is 4.1 hours. Table 4 shows a breakdown of individual task times.

Table 4. Breakdown of Individual Task Times

<table>
<thead>
<tr>
<th>Task</th>
<th>Number of Operators</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inventory between Operating Rooms and Decontamination</td>
<td>N/A</td>
<td>&lt; 1 hour</td>
</tr>
<tr>
<td>Decontamination</td>
<td>1-2</td>
<td>63.8 minutes</td>
</tr>
<tr>
<td>Inventory between Decontamination and Instrument Assembly</td>
<td>N/A</td>
<td>&lt; 3 hour</td>
</tr>
<tr>
<td>Instrument Assembly</td>
<td>4-5</td>
<td>15.3 minutes</td>
</tr>
<tr>
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<td>N/A</td>
<td>&lt; 2.5 hours</td>
</tr>
<tr>
<td>Sterilization</td>
<td>1</td>
<td>163.2 minutes</td>
</tr>
</tbody>
</table>

A larger version of the high level value stream map can be seen in Appendix B. Detailed value stream maps of the decontamination area and the instrument assembly room can be seen in Appendices C – E.
Figure 2. High Level Value Stream Map

Customer Demand
62 – 181 Sets per Day

Operating Room

Daily Pick Sheets

63.8 minutes
< 1 hour
Processing Time: 4.1 hours
Production Lead Time: < 10.6 hours
0 – 14+ sets
0 – 20 sets
62 – 181 Sets per Day
Customer Demand
1-2
Decontamination
C/T: 63.8 minutes
Uptime: 100%
Capacity:
0 – 30 sets

Instrument Assembly
C/T: 15.3 minutes
Uptime: 100%
Capacity:

Sterilization
C/T: 163.2 minutes
Uptime:
Capacity:

Sterile Storage Area

Figure 3 is a box plot showing instrument assembly times broken down by instrument processor. This was generated from 541 data points. This box plot shows that the mean assembly time is 15.3 minutes and that there is a large variation in set assembly time. The standard deviation of this data is 10.1 minutes, on a range of [1, 66] minutes. This variation is caused by the differences in set size and complexity. Also, the Instrument Room Supervisor described a learning affect on set assembly times. She stated that the most senior instrument processors are expected to assemble more sets per shift than the newer instrument processors.

Figure 3. Box plot of Instrument Assembly Times by Instrument Processor
541 total samples collected from November 3, 2008 – December 3, 2008 by IOE 481 team 14
The productivity sheets showed the volumes of tasks being completed in each area of the instrument processing process for April and July. The team analyzed 306 total samples (157 from April and 149 from July). Due to the project’s focus on the current Mott children’s hospital CSS area, July was chosen to represent a month in which a high number of surgeries are scheduled because children are not in school. April was chosen to represent the lower number of surgeries that occur during the school year. Analysis did not include weekends due to the inconsistency of weekend surgery schedules. Figure 4 below and the graphs in Appendix F display the average daily productivity in each section of the process. The overall tendency shows that daily productivity rate in July is higher than April in most cases. The instrument room varies the most in the output of materials or services.

As previously stated, the productivity sheet includes a section to record deliveries to the birth center, University Hospital and the University Hospital CSS area. The team did not include this data in the graph due to the infrequency of deliveries. The average daily deliveries to the birth center were between 0 and 0.1 each day for April and July, and the deliveries to University Hospital averaged 0.2 each day. The deliveries to CSS ranged from 0.9 to 1.0 each day. The most notable differences between months can been seen in average sets assembled and individual instruments processed. July had an 11.9% increase in the number of sets assembled and a 31.6% increase in the number of individual instruments individually wrapped. The other tasks involved in the instrument process had a similar trend between months, with July having the higher volume of the two.

From existing autoclave records, the team generated information detailing the autoclave cycles. The average cycle time for the autoclave in the instrument assembly and sterilization room was 1.2 hours.
with a standard deviation of 2.6 minutes. A full breakdown of the average cycle times of the express cycle autoclaves can be seen in Figure 5. This data includes 171 samples collected from logs dated September 23, 2008 through October 14, 2008. The main autoclave provided 110 samples, and the express cycle autoclaves provided 61 samples.

Figure 5 shows the average number of main autoclave cycles broken down by day of the week. The number of autoclave loads on weekdays remained steady at around six to nine loads daily, while the number of daily autoclave loads on weekends dropped to one to two loads. Figure 6 uses data from 171 samples collected from logs dated September 23, 2008 through October 14, 2008.

Figure 6 shows the average number of main autoclave cycles broken down by day of the week. The number of autoclave loads on weekdays remained steady at around six to nine loads daily, while the number of daily autoclave loads on weekends dropped to one to two loads. Figure 6 uses data from 171 samples collected from logs dated September 23, 2008 through October 14, 2008.
**Measurement of Instrument Trays and Shelving**

The project coordinator provided the specifications of the shelving requirements as stated by the Industrial Engineering Expert and Lean Coach. Table 5 shows the current shelving space in the sterile storage area. This data is divided into two groups, current shelving area for supplies and current shelving area for instrument sets.

<table>
<thead>
<tr>
<th>Usage</th>
<th>Sq. Ft.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>1694</td>
</tr>
<tr>
<td>Supplies</td>
<td>1063</td>
</tr>
<tr>
<td>Instrument Sets</td>
<td>631</td>
</tr>
</tbody>
</table>

Table 6 shows the estimations of the linear footage requirements for instrument sets at current inventory levels. This data is broken down by service.

<table>
<thead>
<tr>
<th>Service</th>
<th>Sq Ft.</th>
<th>Peel Packed Sets</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>1031</td>
<td>69</td>
</tr>
<tr>
<td>Cardiac</td>
<td>105</td>
<td>29</td>
</tr>
<tr>
<td>Transplants</td>
<td>19</td>
<td>8</td>
</tr>
<tr>
<td>ENT</td>
<td>83</td>
<td>1</td>
</tr>
<tr>
<td>Ped Surg</td>
<td>136</td>
<td>0</td>
</tr>
<tr>
<td>Neuro</td>
<td>84</td>
<td>2</td>
</tr>
<tr>
<td>Ophthy</td>
<td>52</td>
<td>7</td>
</tr>
<tr>
<td>Oral</td>
<td>19</td>
<td>0</td>
</tr>
<tr>
<td>Dentistry</td>
<td>21</td>
<td>0</td>
</tr>
<tr>
<td>Plastic</td>
<td>50</td>
<td>1</td>
</tr>
<tr>
<td>Urology</td>
<td>65</td>
<td>12</td>
</tr>
<tr>
<td>Ortho</td>
<td>318</td>
<td>6</td>
</tr>
<tr>
<td>L&amp;D</td>
<td>80</td>
<td>3</td>
</tr>
</tbody>
</table>

**5S Analysis and Implementation**

After initial observations, a 5S analysis was deemed a valuable addition to the project because:

- Workstations are not standardized
- Excess inventory exists, and therefore clutters the already small space
- 18 new employees need training and standardized workstations will assist them
On October 15, the team consulted with a 5S expert from the UMH QI Michigan Quality System to gain insight into the implementation of workstation standardization. To complete the 5S plan, the team measured the workstation’s shelves, workspace, and drawers. Also, the team created a list of supplies needed at each station according to discussions with the instrument assemblers. Organizational materials ordered included:

- 11 7⁄8 in. by 8 ¼ in. by 5 in. red bins to store extra instruments which are not included in normal sets
- 36 in. by 3 in. by 3 in. containers with 12 divisions to be used at each station for storing commonly used materials
- 18 in. by 3 in. by 3 in. containers with four divisions to be used at each station for storing instrument guards

On November 7, the team performed a 5S implementation on the workstation of one of the more senior instrument processors. Before doing any work, the team introduced the concept of 5S to the instrument processor, and then proceeded to work through each of the five steps: sort, sweep, set in order, standardize, and sustain. Throughout the next four weeks, each of the instrument processors were instructed to work at least one shift at the new workstation. During the final implementation instrument processors shared their feedback about this workstation. The team then implemented an improved design to each of the workstations on December 5. To minimize the disruption of productivity, the team has worked on the workstations during low volume times. Excess supplies and unnecessary materials filled four 19 in. by 18 ¼ in. by 14 in. bins and were removed from the area. The results from this analysis can be seen in Figure 7. As shown above, the 5S analysis and implementation eliminated excess inventory clutter and increased organization to optimize work efficiency.

Figure 7: 5S Analysis Results

Before: Typical workstation (10/14) After: Typical workstation (12/5)

Photographs of the complete implementation can be seen in Appendix G.
Recommendations

Through analysis the team has developed recommendations that focus on the current state of instrument processing and the 5S program design and implementation. The team’s primary recommendation is to perform biweekly 5S maintenance on the workstations in the instrument assembly room. The team also recommends a 5S implementation program for the replacement hospital, especially because it can be preplanned. The team has also developed some particular recommendations based on observations of the current process:

- Increase the number of supply deliveries to the instrument assembly room from once to twice daily will resolve clutter and overstocking. This will also increase the amount of available space in the small rooms.
- Redesign the battery inventory storage from an ad hoc to a first in, first out (FIFO) dispensing system to eliminate dead batteries. Time will also be saved in surgical cases where batteries have to be switched midway through the case.
- Move the Bowie Dick and biological indicator tests from the shelf above the workstation to a shelf by the autoclave to create space and eliminate walking time.
- Devise a checkout system for individual instruments to improve misplacement issues. A record may be used to document the location of all instruments to minimize misplacement.
- Use a FIFO method for non-urgent sets in the decontamination area such as a lane or numbering system. Currently sets are processed in no particular order, except when a set is needed immediately.
- Move currently hand wrapped sets to Genesis cases, if possible, as a form of standardization and protection.

Expected Outcomes

The expected outcome of the Mott replacement hospital is to improve the service to patients and improve efficiency of the instrument processing area. Deliverables from this project should lay the foundation for the completion of the new Mott CSS area operational plan. In addition, the standardized workstations should allow for more efficient labor. Finally, the project should provide some general recommendations and identification of waste throughout the process.

Acknowledgements

The team would like to recognize the following individuals for their assistance with this project.

Karen Lam, Nurse Manager, Mott Operating Rooms
- Provided information on problem, purpose, requirements, and expectations
- Supplied contact information

Jesse Wilson, Administrative Manager, Mott Operating Rooms
- Acted as guide and mentor
- Sustained a positive client relationship
- Kept project within scope of course

Susie Peplinski, Instrument Room Supervisor, Mott Operating Rooms
• Provided existing data
• Employee interview assistance

Whitney Walters, Lean Coach, UMH QI Michigan Quality System
• Discussed current 5S methods and helped strategize our implementation

Mary Lind, Technical Communications Lecturer, College of Engineering
• Provided technical communications support
• Reviewed and revised all reports and presentations
Appendix B – High Level Value Stream Map

Mott Children’s Hospital High Level Value Stream Map

Customer Demand
62 - 181 Sets per Day

Operating Room

Daily Pick Sheets

0 - 14+ Sets
0 - 30 Sets
0 - 20 Sets
0 - 14+ Sets

Sterilization

Decontamination

Instrument Assembly

Capacity: 15.3 minutes
Uptime: 100%
Capacity: 16.3 minutes
Uptime: 100%

Processing Time: 4.1 hours

Production Lead Time: > 10.6 hours

Processing Time: 1.8 minutes

Processing Time: 163.2 minutes

Processing Time: 15.3 minutes

Processing Time: 63.8 minutes

Processing Time: 4.1 hours

Processing Time: > 3 hours

Processing Time: < 2.5 hours

Processing Time: < 1 hour
Mott Children’s Hospital Decontamination Area Value Stream Map

For Instrument Sets

Operating Room

Sterile Storage Area

38 - 78 Sets per Day

Customer Demand

Hand Wash

C/T: 4.5 minutes
CO: 70 seconds

Capacity: 15 sets

Spray Rinse Machine

C/T: 2 minutes
Uptime: 100%
Capacity: 2 sets

High Temp. Washer

C/T: 0 - 1.2 sets
Capacity: 3 sets
Uptime: 100%
C/T: 47.5 minutes

Sorting

Spray Rinse Machine

C/T: 0.5 minutes
Uptime: 100%
C/T: 6.5 minutes

Soaking

Sonic Machine

C/T: 4 minutes
Uptime: 75%
Capacity: 3 sets

Instrument Assembly Room

Operating Room

1-2

Processing Time: 63.8 minutes
Production Lead Time: < 3 hours

0 - 14+ sets

0 - 12 sets

47.5 minutes
< 1 hour

16.3 minutes
< 1 hour
Appendix D – Decontamination Area Value Stream Map for Scopes

Instrument Assembly Room

Hand Rinse and Dry

Sterile Storage Area

1 – 10 Scopes per Day

Customer Demand

Operating Room

Mott Children’s Hospital Decontamination Area Value Stream Map

For Scopes

Processing Time: 21 minutes
Time: < 1.5 hours
Production Lead Time: < 1 hour

Metricide Mixture

C/T: 20 minutes
C/O: 2 minutes
Capacity: 1 scope

C/T: 60 seconds

Hand Rinse and Dry

0 – 3 scopes

Daily Pick Sheets

0 – 3 scopes

1 – 10 Scopes per Day

Customer Demand
Appendix E – Instrument Assembly and Sterilization Value Stream Map

Decontamination Room

Set Assembly and Wrapping

Autoclave

Cooling

Operating Room

Mott Children’s Hospital Instrument Assembly and Sterilization Value Stream Map

0 – 20 sets

C/T: 15.3 minutes

CO: 2 minutes

1 – 2 hours

C/T: 71.2 minutes

CO: 10 minutes

Capacity: 30 sets

3 – 6 sets

C/T: 92 minutes

Operating Room

0 – 30 sets

Customer Demand

Mott Children’s Hospital Instrument Assembly and Sterilization Value Stream Map

15.3 minutes

< 2.5 hours

< 7.5 hours

62 – 113 Sets per Day

Co: 30 minutes

Daily Pick Sheets

Sterile Storage Area

163.2 minutes

Processing Time: < 7.5 hours

Production Lead Time: < 7.5 hours

Processing Time: < 7.5 hours
Appendix F – Productivity Data

Decontamination Average Daily Productivity
306 total samples collected from April and July 2008 productivity sheets by IOE 481 team 14

Autoclave Average Daily Productivity
306 total samples collected from April and July 2008 productivity sheets by IOE 481 team 14
Appendix G – 5S Implementation Photos

**Inconsistent Stations**

**Space Constraints**

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**5S Implementation First Trial**
Final 5S Implementation